CLAIMS

What is claimed is:

1. An optical method for transmitting data, comprising:

preparing an optical pulse stream comprising a plurality of return-to-zero optical pulses by modulating a phase of light output by an optical source to thereby encode information from a data source, the light of the optical pulse stream having a wavelength;

transmitting the optical pulse stream along an optical fiber of an optical network.

2. The method of claim 1, wherein the optical pulse stream further comprises a plurality of non-return-to-zero pulses.

3. The method of claim 2, wherein an extinction ratio between adjacent pulses that have a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB.

4. The method of claim 2, wherein an extinction ratio between adjacent pulses that have a relative phase difference of at least about $\pi/2$ is at least about 10 dB.

5. The method of claim 2, wherein an extinction ratio between adjacent pulses that have a relative phase difference of essentially zero is at least about 5 dB and less than about 10 dB.

6. The method of claim 2, wherein an extinction ratio between adjacent pulses having a relative phase difference of at least about $\pi/2$ is at least about 20 dB.

7. The method of claim 1, wherein the wavelength of the optical pulse stream is selected so as to differ from a zero dispersion wavelength of the optical fiber by at least about 50 nanometers.

8. The method of claim 7, wherein wavelength of the optical pulse stream is selected so as to differ from the zero dispersion wavelength by at least about 100 nanometers.

9. The method of claim 7, wherein the wavelength of the optical pulse stream is selected so as to be at least about 50 nanometers greater than the zero dispersion wavelength of the optical fiber.

10. The method of claim 7, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is at least about + 2 picoseconds per nanometer per kilometer.

11. The method of claim 7, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is less than about - 2 picoseconds per nanometer per kilometer.

12. The method of claim 7, wherein the wavelength of the optical pulse stream is selected so as to differ from a zero dispersion wavelength of a non-zero-dispersion shifted fiber by at least about 50 nanometers.

13. The method of claim 7, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is at least about + 15 picoseconds per nanometer per kilometer.

14. The method of claim 7, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is less than about - 15 picoseconds per nanometer per kilometer.

15. The method of claim 7, wherein the wavelength of the optical pulse stream is selected so as to differ from a zero dispersion wavelength of single mode dispersion fiber by at least about 50 nanometers.

16. The method of claim 1, wherein the optical pulse stream has a duty cycle of

less than about 70%.

17. The method of claim 1, further comprising:

prior to modulating the phase of the light, modulating an amplitude of the light output by the optical source to provide an optical pulse stream.

18. The method of claim 1, wherein the optical pulse stream is a binary phase shift keyed BPSK optical signal.

19. The method of claim 1, wherein the optical pulse stream is a quarternary phase shift keyed QPSK optical signal.

20. An optical method for transmitting data, comprising

preparing an optical pulse stream comprising a plurality of return-to-zero optical pulses and a plurality of non-return-to-zero pulses, by modulating a phase of light output by an optical source to thereby encode data from a data source;

transmitting the optical pulse stream along an optical fiber of an optical network.

21. An optical method for transmitting data, comprising

preparing an optical pulse stream comprising a plurality of return-to-zero optical pulses and a plurality of non-return-to-zero pulses, by modulating a phase of light output by an optical source to thereby encode data from a data source, wherein an extinction ratio between adjacent pulses that have a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB;

transmitting the optical pulse stream along an optical fiber of an optical network.

22. A method for receiving optically encoded data, comprising:

receiving an optical pulse stream comprising return-to-zero optical pulses, pulses of the optical pulse stream having been phase-modulated to encode data, the optical pulse stream having traveled within an optical fiber of an optical

network; and

demodulating the optical pulse stream to thereby decode the data.

23. The method of claim 22, wherein the optical pulse stream further comprises non-return-to-zero pulses.

24. The method of claim 23, wherein an extinction ratio between adjacent pulses of the optical pulse stream having a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB.

25. The method of claim 23, wherein an extinction ratio between adjacent pulses having a relative phase difference of at least about $\pi/2$ is at least about 10 dB.

26. The method of claim 23, wherein an extinction ratio between adjacent pulses of the optical pulse stream having a relative phase difference of essentially zero is at least about 5 dB and less than about 10 dB.

27. The method of claim 23, wherein an extinction ratio between adjacent pulses having a relative phase difference of at least about $\pi/2$ is at least about 20 dB.

28. The method of claim 22, wherein the wavelength of the optical pulse stream was selected so as to differ from a zero dispersion wavelength of the optical fiber by at least about 50 nanometers.

29. The method of claim 28, wherein the wavelength of the optical pulse stream was selected so as to differ from the zero dispersion wavelength by at least about 100 nanometers.

30. The method of claim 28, wherein the wavelength of the optical pulse stream was selected so as to be at least about 50 nanometers greater than the zero dispersion wavelength of the optical fiber.

31. The method of claim 22, wherein the wavelength of the optical pulse stream

was selected so that the dispersion of the optical fiber is at least about + 15 picoseconds per nanometer per kilometer.

32. The method of claim 22, wherein the wavelength of the optical pulse stream was selected so that the dispersion of the optical fiber is less than about - 15 picoseconds per nanometer per kilometer.

33. The method of claim 22, wherein the wavelength of the optical pulse stream was selected so as to differ from a zero dispersion wavelength of single mode dispersion fiber by at least about 50 nanometers.

34. The method of claim 22, wherein the optical pulse stream has a duty cycle of less than about 70%.

35. The method of claim 22, wherein the optical pulse stream is a binary phase shift keyed optical (BPSK) pulse stream.

36. The method of claim 22, wherein the optical pulse stream is a quaternary phase shift keyed (QPSK) optical pulse stream.

37. The method of claim 22, further comprising the step of correcting the optical pulse stream for chromatic dispersion caused by the optical pulse stream.

38. A method for optically transmitting data, comprising:

preparing a first optical pulse stream comprising first return-to-zero optical pulses by modulating a phase of first light output by a first optical source to thereby encode data from a first data source;

preparing a second optical pulse stream comprising second return-to-zero optical pulses by modulating a phase of second light output by a second optical source to thereby encode data from a second data source;

combining the first and second modulated optical pulse streams to prepare an optical signal having a wavelength; and

transmitting the optical signal along an optical fiber of an optical

fiber network.

39. The method of claim 38, wherein the optical signal is a quaternary phase shift keyed optical signal.

40. The method of claim 38, wherein the optical signal further comprises non-return-to-zero optical pulses.

41. The method of claim 40, wherein an extinction ratio between adjacent pulses that have a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB.

42. The method of claim 41, wherein an extinction ratio between adjacent pulses that have a relative phase difference of at least about $\pi/2$ is at least about 10 dB.

43. The method of claim 41, wherein an extinction ratio between adjacent pulses that have a relative phase difference of essentially zero is at least about 5 dB and less than about 10 dB.

44. The method of claim 42, wherein an extinction ratio between adjacent pulses having a relative phase difference of at least about $\pi/2$ is at least about 20 dB.

45. The method of claim 38, wherein the wavelength of the optical pulse stream is selected so as to differ from a zero dispersion wavelength of the optical fiber by at least about 50 nanometers.

46. The method of claim 45, wherein wavelength of the optical pulse stream is selected so as to differ from the zero dispersion wavelength by at least about 100 nanometers.

47. The method of claim 45, wherein the wavelength of the optical pulse stream is selected so as to be at least about 50 nanometers greater than the zero

dispersion wavelength of the optical fiber.

48. The method of claim 45, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is at least about + 2 picoseconds per nanometer per kilometer.

49. The method of claim 45, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is less than about - 2 picoseconds per nanometer per kilometer.

50. The method of claim 45, wherein the wavelength of the optical pulse stream is selected so as to differ from a zero dispersion wavelength of a non-zero-dispersion shifted fiber by at least about 50 nanometers.

51. The method of claim 45, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is at least about + 15 picoseconds per nanometer per kilometer.

52. The method of claim 45, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is less than about - 15 picoseconds per nanometer per kilometer.

53. The method of claim 45, wherein the wavelength of the optical pulse stream is selected so as to differ from a zero dispersion wavelength of single mode dispersion fiber by at least about 50 nanometers.

54. The method of claim 38, wherein each optical pulse stream has a duty cycle of less than about 70%.

55. A method for optically transmitting data, comprising:

preparing a plurality of phase shift keyed (PSK) optical pulse streams, each optical pulse stream comprising a plurality of return-to-zero optical pulses, each optical pulse stream encoding data from a respective data source;

combining the optical pulse streams to prepare a time division multiplexed (TDM) optical signal having a wavelength;

transmitting the TDM optical signal within an optical fiber of an optical fiber network.

56. The method of claim 55, wherein the optical pulse streams further comprise a plurality of non-return-to-zero pulses.

57. The method of claim 56, wherein an extinction ratio between adjacent pulses that have a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB.

58. The method of claim 57, wherein an extinction ratio between adjacent pulses that have a relative phase difference of at least about $\pi/2$ is at least about 10 dB.

59. The method of claim 57, wherein an extinction ratio between adjacent pulses that have a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB.

60. The method of claim 57, wherein an extinction ratio between adjacent pulses having a relative phase difference of at least about $\pi/2$ is at least about 20 dB.

61. The method of claim 55, wherein the wavelength of the optical signal is selected so as to differ from a zero dispersion wavelength of the optical fiber by at least about 50 nanometers.

62. The method of claim 61, wherein wavelength of the optical signal is selected so as to differ from the zero dispersion wavelength by at least about 100 nanometers.

63. The method of claim 61, wherein the wavelength of the optical pulse stream is selected so as to be at least about 50 nanometers greater than the zero

dispersion wavelength of the optical fiber.

64. The method of claim 61, wherein the wavelength of the optical signal is selected so that the dispersion of the optical fiber is at least about + 2 picoseconds per nanometer per kilometer.

65. The method of claim 61, wherein the wavelength of the optical signal is selected so that the dispersion of the optical fiber is less than about - 2 picoseconds per nanometer per kilometer.

66. The method of claim 61, wherein the wavelength of the optical signal is selected so as to differ from a zero dispersion wavelength of a non-zero-dispersion shifted fiber by at least about 50 nanometers.

67. The method of claim 61, wherein the wavelength of the optical signal is selected so that the dispersion of the optical fiber is at least about + 15 picoseconds per nanometer per kilometer.

68. The method of claim 61, wherein the wavelength of the optical pulse stream is selected so that the dispersion of the optical fiber is less than about - 15 picoseconds per nanometer per kilometer.

69. The method of claim 61, wherein the wavelength of the optical pulse stream is selected so as to differ from a zero dispersion wavelength of single mode dispersion fiber by at least about 50 nanometers.

70. The method of claim 55, wherein each of the respective optical pulse streams have a duty cycle of less than about 70%.

71. A system for transmitting and receiving optically encoded data, comprising:

at least one transmitter configured to:

modulate a phase of respective return-to-zero optical pulses and

non-return-to-zero pulses of an optical pulse stream to thereby prepare an optical signal comprising return-to-zero and non-return-to-zero optical pulses encoded with data from a data source; and

transmit the optical signal along an optical fiber of an optical network; and

at least one receiver configured to:

demodulate the return-to-zero optical pulses to thereby decode the data from the optical signal.

72. The system of claim 71, wherein the transmitter is configured to modulate a phase of the light output by the optical source prior to modulating an amplitude of the light.

73. A fiber optic network for carrying optical signals, comprising:

at least one optical fiber having embedded therein an optical signal comprising return-to-zero phase shift key (PSK) optical pulses.

74. The fiber optic network of claim 73, wherein the optical signal further comprises a plurality of non-return-to-zero optical pulses.

75. The method of claim 73, wherein the optical fiber has a zero dispersion wavelength of less than about 1500 nanometers.

76. The method of claim 75, wherein the optical signal has a wavelength of between about 1500 nanometers and about 1625 nanometers.

77. The method of claim 73, wherein a dispersion of the optical fiber is at least about 2 picoseconds per nanometer per kilometer at a wavelength of the optical signal.

78. The method of claim 73, wherein a dispersion of the optical fiber is less than about 2 picoseconds per nanometer per kilometer at a wavelength of the optical signal.

79. The method of claim 73, wherein the optical fiber is a non-zero-dispersion shifted fiber.

80. The method of claim 73, wherein a dispersion of the optical fiber is at least about +15 picoseconds per nanometer per kilometer at a wavelength of the optical signal.

81. The method of claim 73, wherein a dispersion of the optical fiber is less than about -15 picoseconds per nanometer per kilometer at a wavelength of the optical signal.

82. The method of claim 73, wherein the optical fiber is single mode dispersion fiber having a zero dispersion wavelength of about 1310 nanometers.

83. The method of claim 73, wherein an extinction ratio between adjacent pulses of the optical signal that have a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB.

84. The method of claim 83, wherein an extinction ratio between adjacent pulses that have a relative phase difference of at least about $\pi/2$ is at least about 10 dB.

85. A method for optically transmitting data, comprising:

preparing a plurality of phase shift keyed (PSK) optical data streams, each PSK optical data stream having a different wavelength and encoding data from at least one respective data source;

combining the PSK optical data streams to prepare a wavelength division multiplexed (WDM) optical signal;

modulating an amplitude of the WDM optical signal to prepare a phase shift keyed wavelength division multiplex (PSKWDM) optical signal comprising a plurality of return-to-zero optical pulses;

transmitting the PSKWDM optical signal along an optical fiber of an optical fiber network.

86. The method of claim 85, wherein the PSKWDM optical signal further comprises a plurality of non-return to zero optical pulses.

87. The method of claim 85, wherein each PSK optical data stream is a binary phase shift keyed BPSK optical data stream encoding data from a single respective data source.

88. The method of claim 85, wherein each PSK optical data stream is a quaternary phase shift keyed optical data stream encoding data from a respective pair of data sources.

89. The method of claim 85, wherein modulating an amplitude is performed after combining the PSK optical data streams.

90. The method of claim 85, wherein preparing a plurality of PSK optical data streams comprises modulating a phase of light provided by a cw light source.

91. The method of claim 85, wherein an extinction ratio between adjacent pulses of a respective one of the optical pulse stream having a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB.

92. The method of claim 91, wherein an extinction ratio between adjacent pulses having a relative phase difference of at least about $\pi/2$ is at least about 10 dB.

93. The method of claim 92, wherein an extinction ratio between adjacent pulses of the optical pulse stream having a relative phase difference of essentially zero is at least about 5 dB and less than about 8 dB.

94. The method of claim 93, wherein an extinction ratio between adjacent pulses having a relative phase difference of at least about $\pi/2$ is at least about 20 dB.

95. A self-homodyne method for demodulating data phase-encoded within a

phase shift key (PSK) optical signal having a plurality of return-to-zero optical pulses, comprising:

splitting the optical signal into first and second split optical signals, the first and second split optical signals each comprising a respective plurality of return-to-zero optical pulses having a bit period T;

delaying the first split optical signal by an integer multiple of the bit period T relative to the second split optical signal;

recombining the first and second split optical signals to prepare first and second output optical signals, the first and second split optical signals interfering upon recombination to thereby convert phase-encoded data to amplitude encoded data; and

detecting at least one of the output optical signals to obtain an output signal indicative of data encoded by the PSK optical signal.

96. The self-homodyne method of claim 95, wherein detecting comprises using a balanced photodetector to detect the first and second output signals.

97. The self-homodyne method of claim 95, wherein the first optical signal is delayed by one bit period.

98. The self-homodyne method of claim 95, wherein the first and second optical signals each further comprise a respective plurality of non-return-to-zero optical pulses.

99. The self-homodyne method of claim 98, wherein an extinction ratio between adjacent pulses that have a relative phase difference of essentially zero is at least about 3 dB and less than about 8 dB.

100. The method of claim 99, wherein an extinction ratio between adjacent pulses that have a relative phase difference of at least about $\pi/2$ is at least about 10 dB.

101. A homodyne method for recovering data phase encoded within a phase shift key (PSK) optical signal having a plurality of phase modulated return-to-zero optical

pulses, comprising:

mixing the PSK optical signal with a local light beam to prepare first and second pairs of mixed optical beams, phase modulated return to zero pulses PSK optical signal and local light beam interfering upon mixing;

detecting the first pair of mixed beams to thereby obtain a first pair of electrical currents;

detecting the second pair of mixed beams to thereby obtain a second pair of electrical currents;

processing the first and second pair of electrical currents to thereby recover phase encoded data from the PSK optical signal.

102. The method of claim 101, wherein processing the first and second pair of electrical currents comprises preparing a first differential current representative of a difference between the members of the first pair of electrical currents and preparing a second differential current representative of a difference between the members of the second pair of electrical currents.

103. The method of claim 101, wherein the local light source is a continuous wave optical beam.

104. The method of claim 101, wherein the local light source is a pulsed optical beam.